Application Number: 10/517,674
Amendment Dated: June 4, 2007
Reply to Office Action Dated January 4, 2007

LISTING OF THE CLAIMS

1.   (currently amended)   A method for charging an electrical storage device so as to extend the life thereof, the method comprising the steps of:

developing an essentialized cell model structure of the electrical storage device;

determining model parameters for charge-discharge data of said the structure; and

determining charge-discharge behavior of said the structure in a voltage-charge plane,

measuring voltage values of the structure based upon the charge-discharge behavior; and

deriving an instantaneous damage rate from the measured voltage values.

2.   (cancelled)

3.   (currently amended)   The method according to claim [[2]] 1, further comprising the steps of:

developing a charging profile based upon said the instantaneous damage rate, wherein said the charging profile optimizes a charging current with respect to the damage per cycle so as to extend the overall life of the electrical storage device.

4.   (currently amended)   An optimal re-charging controller for an electrical storage device[[,]] comprising:

a simulation processor receiving an input signal sent to the electrical storage device and a measured output signal generated by the electrical storage device, wherein said the simulation processor models a plurality of states of the electrical storage device and generates an estimated output signal so that the controller mitigates damage to the electrical storage device, and wherein the simulation processor comprises:

4

Application Number: 10/517,674
Amendment Dated: June 4, 2007
Reply to Office Action Dated January 4, 2007

<u>a feedback component which receives the measured output signal and the estimated output signal to generate a correction signal; and</u>

<u>an observer component which receives the correction signal and the input signal to generate the estimated output signal and an estimated internal state signal, wherein the estimated output signal converges a plurality of modeled dynamic states to corresponding states of the electrical storage device, and wherein the correction signal represents a real-time estimate of the amount of damage being done to the electrical storage device during re-charging.</u>

5.   (cancelled)

6.   (cancelled)

7.   (currently amended)   The controller according to claim [[5]] 4, wherein said the damage rate sensor generates said the estimated output signal such that a charging current applied to the electrical storage device is applied slowly at the beginning of the charge.

8.   (currently amended)   The controller according to claim [[5]] 4, wherein said the damage rate sensor generates said the estimated output signal such that a charging current is applied more during a first half of a charging period than in a second half of said the charging period.

9.   (currently amended)   The controller according to claim [[5]] 4, wherein said the damage rate sensor generates said the estimated output signal such that a charging current applied to the electrical storage device is decreased slowly to zero amperes at the end of a charging period.

5

10. (currently amended) The controller according to claim [[5]] 4, wherein said the observer component contains model parameters of the electrical storage device which are updated as they change over the life thereof.

11. (currently amended) The controller according to claim [[5,]] 4 further comprising:

a damage rate sensor which receives said the input signal, said the estimated output signal and aid estimated internal state signal to generate a damage rate signal which estimates the amount of damage being done to the electrical storage device.

12. (currently amended) The controller according to claim 11, further comprising:

a supervisory intelligent controller for receiving said the estimated internal state signal, said measure the measured output signal, said the damage rate signal and a desired performance input signal, wherein said the supervisory intelligent controller generates a charging profile signal.

13. (currently amended) The controller according to claim 12, further comprising:

a battery control system for receiving said the measured output signal, said the estimated internal state signal and said the charging profile signal to generate said the input signal, wherein said the battery control system adjusts said the input signal to optimize charging of the electrical storage device to maximize the life thereof.

6